Lloyd's Register

Rules and Regulations for the Manufacture, Testing and Certification of Materials, July 2012

Notice No. 2

Effective Date of Latest Amendments:

See page 1

Issue date: February 2013

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RULES AND REGULATIONS FOR THE MANUFACTURE, TESTING AND CERTIFICATION OF MATERIALS, *July 2012*

Notice No. 2

This Notice contains amendments within the following Sections of the *Rules and Regulations for the Manufacture, Testing and Certification of Materials, July 2012.* The amendments are effective on the dates shown:

Chapter	***Section***	***Effective date***
1	2, 3, 6	1 July 2013
2	1, 8	1 July 2013
3	1, 3	Corrigenda
4	1, 4, 5, 8	1 July 2013
4	1	Corrigendum
5	1, 2, 3, 9	1 July 2013
6	1	1 July 2013
9	1, 3	1 July 2013
10	2, 3, 5	1 July 2013
10	3	Corrigendum
12	2	1 July 2013
13	1, 2, 4	1 July 2013
14	2, 5	1 July 2013

It will be noted that the amendments also include corrigenda, which are effective from the date of this Notice.

The *Rules and Regulations for the Manufacture, Testing and Certification of Materials, July 2012* are to be read in conjunction with this Notice No. 2. The status of the Rules is now:

Rules for Materials	Effective date:	July 2012
Notice No. 1	Effective date:	1 January 2013 & Corrigenda
Notice No. 2	Effective date:	1 July 2013 & Corrigenda

Chapter 1

General Requirements

Effective date 1 July 2013

■ *Section 2*
Approval and survey requirements

2.2 LR Approval – General

2.2.14 The approved works will be subject to a periodic inspection of all relevant parts of the works, at intervals not exceeding three years. The procedure for this periodic inspection is given in Book B of LR's *Materials and Qualification Procedures for Ships* (MQPS). This periodic inspection is in addition to the regular visits made according to 2.3.7.

2.3 Materials Survey Scheme

~~*2.3.9* For a manufacturer to maintain approval under this scheme, the works will be subject to a periodic inspection of all relevant parts of the works, at intervals not exceeding three years. The procedure for this periodic inspection is given in Book B of LR's *Materials and Qualification Procedures for Ships* (MQPS). This periodic inspection is in addition to the regular visits made according to 2.3.7.~~

2.4 Materials Quality Scheme

(*Part only shown*)

2.4.1 The manufacturer may apply to be approved under the Materials Quality Scheme, where the following requirements are met:

(a) The manufacturer has been approved by LR for a minimum of three years and continues to maintain their LR works approval according to 2.2.14; and

2.4.15 Once every three years, a full assessment of scheme compliance will be conducted by a Surveyor who is not the regular attending Surveyor. This assessment is in addition to the periodic inspection requirement made according to 2.2.14.

■ *Section 3*
Certification of materials

3.1 General

(*Part only shown*)

3.1.3 The following certificate types are to be used, (a) and (b) for the Materials Survey Scheme, and (d) for the Materials Quality Scheme:

(b) **Manufacturer's certificate validated by LR**
A manufacturer's certificate, validated by LR on the basis of inspection and testing carried out ~~on the delivered product~~ by the manufacturer and which is in accordance with the requirements of these Rules, may be accepted.

■ *Section 6*
References

6.1 General

Table 1.6.1 List of National and International Standards (*Part only shown*)

Rule reference	Standard
Chapter 2 – Testing Procedures for Metallic Materials	ISO 6506-1: 2006 ISO 6506-2: 2006 ISO 6506-3: 2006 ISO 6507-1: 2006 ISO 6507-2: 2006 ISO 6507-3: 2006 ISO 6508-1: 2006 ~~ASTM E23-07ae1~~ ASTM E23-07a
Chapter 3 – Rolled Steel Plates, Strip, Sections and Bars	~~ASTM E112-96 (2004)e2~~ ASTM E112-2010 ~~ASTM A255-10~~ ASTM A255-2010
Chapter 5 – Steel Forgings	~~ASTM E112-10~~ ASTM E112-2010
Chapter 9 – Copper Alloys	~~ASTM E272-10~~ ASTM E272-2010 EN 1057: 2006 +A1: 2010
Chapter 10 – Equipment for Mooring and Anchoring	~~ASTM E112-10~~ ASTM E112-2010 ~~ASTM A255-10~~ ASTM A255-2010
Chapter 12 – Welding Qualifications	~~ISO 6947: 1997~~ ISO 6947: 2011
Chapter 13 – Requirements for Welded Construction	~~SNT-TC-1A: 2006~~ SNT TC-1A-2011 AWS D3.6M:2010
Chapter 14 – Plastics Materials	~~ISO 178: 2010~~ ISO 178: 2010 ~~ASTM C273/C273M-07^{a}~~ ASTM C273/C273M-06 2011 ~~ASTM C393/C393M-06~~ ASTM C393/C393M-2011 ~~ISO 75: 1999~~ ISO 175: 2010 BS 1088-1: 2003 BS 1088-2: 2003

Chapter 2

Testing Procedures for Metallic Materials

Effective date 1 July 2013

Section 1

General requirements for testing

1.2 Testing machines

1.2.4 Hardness testing machines, together with their associated measuring microscopes, are to be directly and indirectly calibrated to ISO 6506-2, 6507-2 or equivalent standards applicable to the type of hardness test. Other National Standards equivalent to ISO 6507-2 and 6506-2 standards may be considered. Routine hardness checks with standard hardness blocks calibrated to ISO 6506-3 or ISO 6507-3 or equivalent are to be carried out at a frequency which demonstrates calibration consistency.

Section 8

Hardness testing

8.1 Dimensions of test specimens

8.1.1 Test pieces must be held rigidly in relation to the indenter and located such that the surface to be tested is at right angles to the axis of the indenter.

8.1.2 The surface finish of the test piece is to be such as to be able to measure the indent accurately.

8.2 Testing procedure

8.2.1 Hardness testing is to be carried out according to ISO 6506-1, ISO 6507-1 or equivalent for the type of hardness test.

Existing Section 8 *has been renumbered* Section 9.

Chapter 3

Rolled Steel Plates, Strip, Sections and Bars

CORRIGENDA

Section 1

General requirements

1.3 Manufacture

(*Part only shown*)
1.3.4 Material may be supplied either as-rolled, normalised, normalising rolled, or thermomechanically controlled rolled. The following definitions apply:

(f) Quenching and Tempering (QT),is a heat treatment process in which steel is heated to an appropriate temperature above the ~~A_{c3}~~ A_{c3} and then cooled with an appropriate coolant for the purpose of hardening the microstructure, followed by tempering, a process in which the steel is re-heated to an appropriate temperature, not higher than the ~~A_{c1}~~ A_{c1} to restore the toughness properties by improving the microstructure.

1.5 Dimensional tolerances

1.5.2 The average thickness of a product or products is defined as the arithmetic mean of the measurements made in accordance with the requirements in ~~1.5.10~~ 1.5.11.

■ *Section 3*
Higher strength steels for ship and other structural applications

3.5 Condition of supply

Table 3.3.5 Conditions of supply for plates and wide flats

Grade	Grain refining practice (*see* Note 1)	Thickness range mm	Conditions of supply (*see* Note 2)				
AH 27S AH 32 AH 36	Al or Al + Ti	≤ 20	AR	N	NR	TM	
		>20 ≤ 100	—	N	NR	TM	(*see* Note 3)
	Nb or V or Al + (Nb or V) or Al + (Ti) + (Nb or V)	≤ 12,5	AR	N	NR NR	TM	
		>12,5 ≤ 100	—	N		TM	
AH 40	Any practice	≤ 12,5	AR	N	NR	TM	
		>12,5 ≤ 50	—	N	NR	TM	
		>50 ≤ 100	—	N	—	TM	QT
~~AH 47~~ ~~DH 47~~ ~~EH 47~~ ~~FH 47~~	~~Any practice~~	~~≤ 50~~	~~Not applicable~~				
		~~>50 ≤100~~	~~TM~~				
DH 27S DH 32 DH 36	Al or Al + Ti	≤ 20	AR	N	NR	TM	
		>20 ≤ 100	—	N	NR	TM	(*see* Note 4)
	Nb or V or Al + (Nb or V) or Al + (Ti) + (Nb or V)	≤ 12,5	AR	N	NR	TM	
		>12,5 ≤ 100	—	N	NR	TM	
DH 40	Any practice	≤ 50	—	N	NR	TM	
		>50 ≤ 100	—	N	—	TM	QT
EH 27S EH 32 EH 36	Any practice	≤ 100	—	N	—	TM	
EH40	Any practice	≤ 100	—	N	—	TM	QT
FH 27S FH 32 FH 36 FH 40	Any practice	≤ 100	—	N	—	TM	QT
AH 47 DH 47 EH 47 FH 47	Any practice	≤ 50	Not applicable				
		>50 ≤100	TM				

NOTES
1. Grain refining elements used singly or in any combination, require specific approval from Materials and NDE Department, London office.
2. AR = as-rolled N = furnace normalised NR = normalising rolled
   TM = thermomechanically controlled-rolled QT = quenched and tempered
3. Material up to 35 mm thick may be supplied in the as-rolled condition provided that prior approval has been obtained from LR.
4. Material up to 25 mm thick may be supplied in the as-rolled condition provided that prior approval has been obtained from LR.

Chapter 4

Steel Castings

Effective date 1 July 2013

Section 1

General requirements

1.5 Heat treatment

1.5.2 Heat treatment is to be carried out in a properly constructed furnace which is efficiently maintained and has adequate means of temperature control ~~and is fitted with pyrometers which measure and record the temperature of the furnace charge~~. The furnace dimensions are to be such as to allow the ~~whole furnace charge~~ steel castings to be uniformly heated to the necessary temperature. Sufficient thermocouples are to be connected to the ~~furnace charge~~ steel castings to show that ~~its~~ their temperature is adequately uniform and the temperatures are to be recorded throughout the heat treatment. Alternative procedures are to be approved by LR, Materials and NDE department. Copies of these records are to be presented to the Surveyor together with a sketch showing the positions at which the temperature measurements were carried out. The records are to identify the furnace that was used and give details of the ~~charge~~ individual steel castings, the heat treatment temperature and time at temperature and the date. The Surveyor is to examine the charts and confirm the details on the certificate. In the case of very large components which require heat treatment, alternative methods will be specially considered.

CORRIGENDUM

1.7 Visual and non-destructive examination

1.7.5 All castings are to be presented to the Surveyor for visual examination. Where applicable, this is to include the examination of internal surfaces. Castings are to be subject to magnetic particle examination or dye penetrant inspection (for austenitic stainless steel castings, *see* Section 8) in accordance with 1.7.9, unless more specific requirements for ~~non-destrutive~~ non-destructive examination are included in subsequent Sections of this Chapter, other parts of the Rules or the agreed specification.

Effective date 1 July 2013

Section 4

Castings for crankshafts

4.7 Rectification of defective castings

4.7.10 All castings are to be given a preliminary refining heat treatment prior to the commencement of welding. Before welding, the material is to be preheated in accordance with the qualified procedure. Where possible, preheating is to be carried out in a furnace. The preheat temperature is to be maintained until welding is completed, and preferably until the casting is ~~charged to~~ placed in the furnace for post-weld heat treatment.

Section 5

Castings for propellers

5.4 Mechanical tests

5.4.4 As an alternative to 5.4.3, where a number of small propeller castings of about the same size, and less than 1 m in diameter, are made from one cast and heat treated together in the same furnace ~~charge~~, a batch testing procedure may be adopted using separately cast test samples of suitable dimensions. At least one set of mechanical tests is to be provided for each multiple of five castings in the batch.

Section 8

Stainless steel castings

8.5 Intergranular corrosion tests

8.5.2 Where an intergranular corrosion test is specified, it is to be carried out in accordance with the procedure given in ~~Ch 2,8.1~~ Ch 2,9.1.

Chapter 5

Steel Forgings

Effective date 1 July 2013

■ *Section 1*
General requirements

1.1 Scope

1.1.4 Normalised forgings with mass up to 1000 kg each ~~and quenched and tempered forgings with mass up to 500 kg each~~ may be batch tested. A batch is to consist of forgings of similar shape and dimensions, made from the same steel-making heat ~~of steel~~, heat treated together ~~in the same furnace charge~~ and with a total mass not exceeding 6 tonnes~~ for normalised forgings and 3 tonnes for quenched and tempered forgings, respectively~~.

1.1.5 Quenched and tempered forgings with mass up to 500 kg each may be batch tested. A batch is to consist of forgings of similar shape and dimensions, made from the same steel-making heat, heat treated together in the same furnace and with a total mass not exceeding 3 tonnes.

Existing paragraphs 1.1.5 *and* 1.1.6 *have been renumbered* 1.1.6 *and* 1.1.7.

1.5 Heat treatment

~~*1.5.2* Heat treatment is to be carried out in properly constructed furnaces, which are efficiently maintained and have adequate means for control and recording of temperature. The furnace dimensions are to be such as to allow the whole furnace charge to be uniformly heated to the necessary temperature. In the case of very large forgings, alternative methods of heat treatment will be specially considered. Sufficient thermocouples are to be connected to the furnace charge to measure and record that its temperature is adequately uniform. Alternative procedures are to be approved by LR, Materials and NDE Department.~~

1.5.2 Heat treatment is to be carried out in a properly constructed furnace which is efficiently maintained and has adequate means of temperature control. The furnace dimensions are to be such as to allow all the steel forgings to be uniformly heated to the necessary temperature. In the case of very large forgings, alternative methods of heat treatment will be specially considered. Sufficient thermocouples are to be connected to the steel forging(s) in the furnace to show that the temperature is adequately uniform and the temperatures are to be recorded throughout the heat treatment. Copies of these records are to be presented to the Surveyor together with a sketch showing the positions at which the temperature measurements were carried out. The records are to identify the furnace that was used and give details of the steelmaking heat, the heat treatment temperature, time at temperature and the date. The Surveyor is to examine the charts and confirm the details on the certificate. Alternative procedures are to be approved by LR's Materials and NDE Department.

1.6 Test material

1.6.2 Where a forging is subsequently divided into a number of components, all of which are heat treated together in the same furnace ~~charge~~, for test purposes this may be regarded as one forging and the number of tests required is to be related to the total length and mass of the original multiple forging, *see* 2.4.2.

1.6.4 Where a number of small forgings of about the same size are made from one cast and heat treated together in the same furnace ~~charge~~, batch testing procedures (*see* 1.1.4) may be adopted using one of the forgings for test purposes, or alternatively using separately forged test samples. These test samples are to have a forging reduction similar to that used for the forgings which they represent. They are to be properly identified and heat treated together with the forgings.

1.8 Visual and non-destructive examination

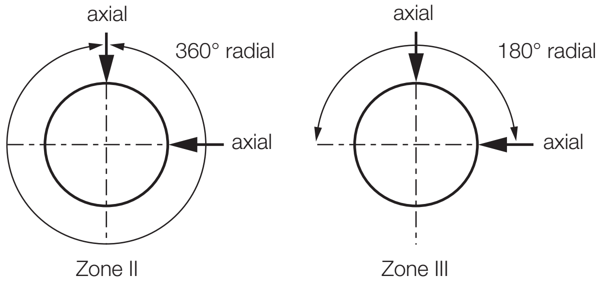
1.8.8 Where required, ultrasonic examination is to be carried out after the forgings have been machined to a condition suitable for this type of examination and after the final heat treatment. Both radial and axial scanning are to be carried out where appropriate for the shape and the dimensions of the forgings being examined. ~~Unless otherwise agreed, this examination is~~ Scanning is to take into account near surface examination. Unless otherwise agreed, examinations are to be carried out by the manufacturer, although Surveyors may request to be present in order to verify that the examination is being carried out in accordance with the agreed procedure.

■ *Section 2*
Forgings for ship and other structural applications

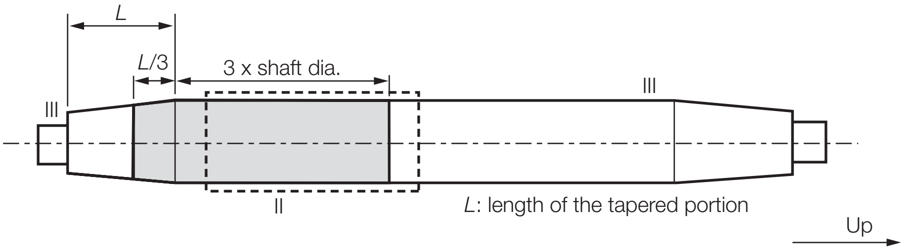
2.5 Non-destructive examination

2.5.7 Ultrasonic testing is to be carried out in the zones I to III as indicated in Fig. 5.2.2. Areas may be upgraded to a higher zone at the discretion of the ~~Surveyors~~ Surveyor.

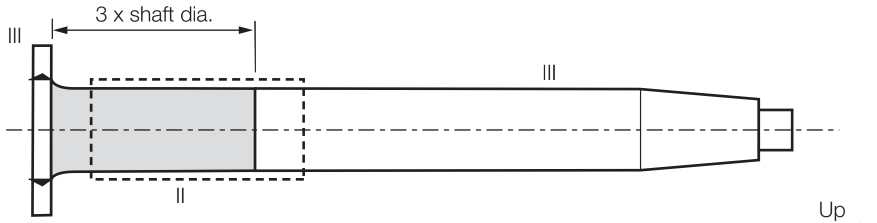
2.5.8 Ultrasonic acceptance criteria are shown in Table 5.3.4, alternatively *see* Ch 1,5.



Scanning direction for Type A and Type B

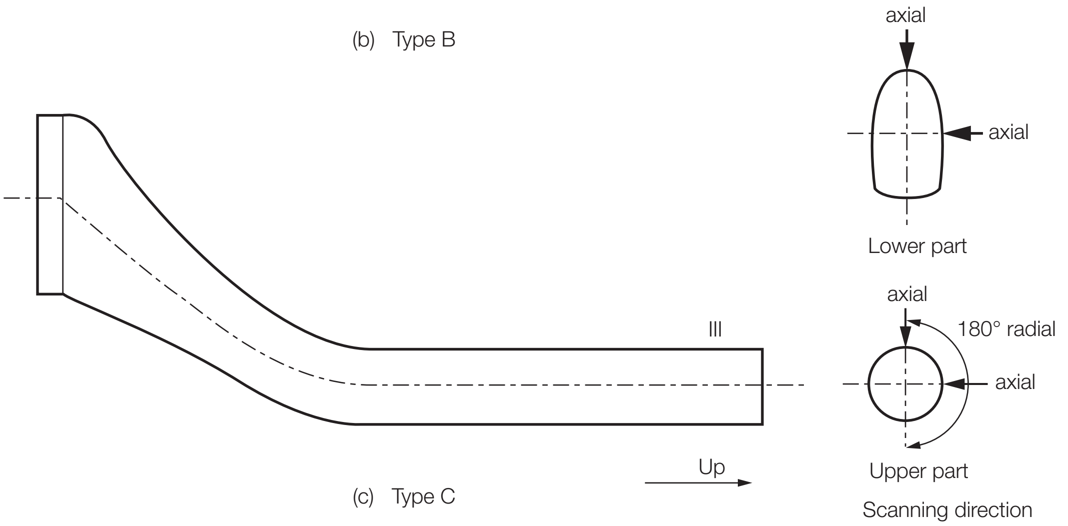


(a) Type A



NOTE
Special consideration is given to the welded areas

(b) Type B



(c) Type C

Scanning direction
for Type C

NOTE
Axial scan from end face also required for Type A and Type B

Fig. 5.2.2 Inspection zones for ultrasonic testing on rudder stocks

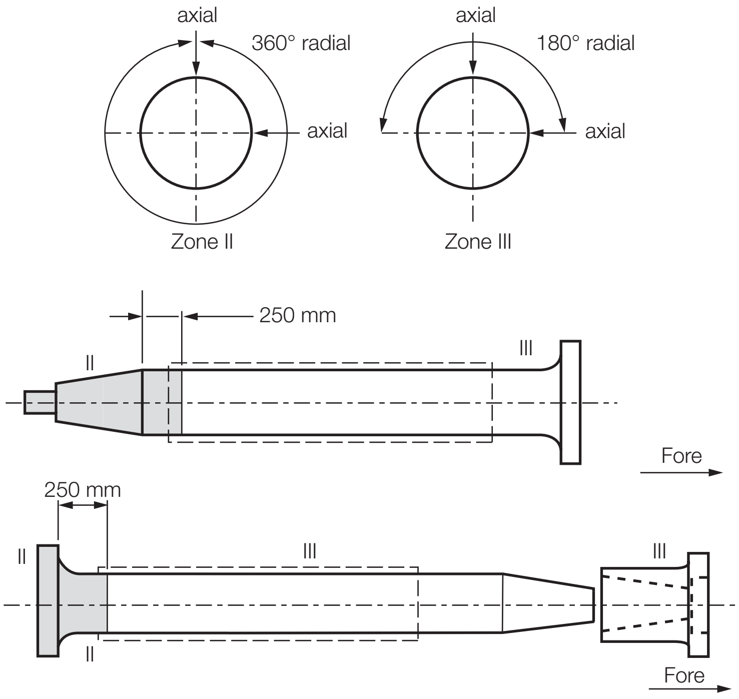
Section 3
Forgings for shafting and machinery

3.4 Mechanical tests

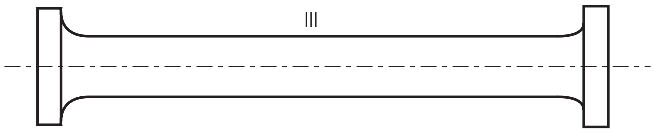
3.4.3 A batch testing procedure may be used for hot rolled bars not exceeding 250 mm diameter, which are intended for the manufacture (by machining operations only) of straight shafting, bolts, studs and other machinery components of similar shape. A batch is to consist of either:

(a) material from the same piece provided that, where this is cut into individual lengths, these are all heat treated together in the same furnace ~~charge~~; or

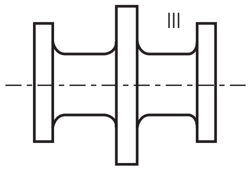
(b) bars of the same diameter and cast, heat treated together in the same furnace ~~charge~~ and with a total mass not exceeding 2,5 tonnes.



(a) Propeller shaft



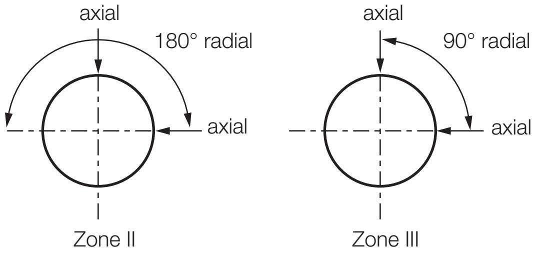
(b) Intermediate shaft



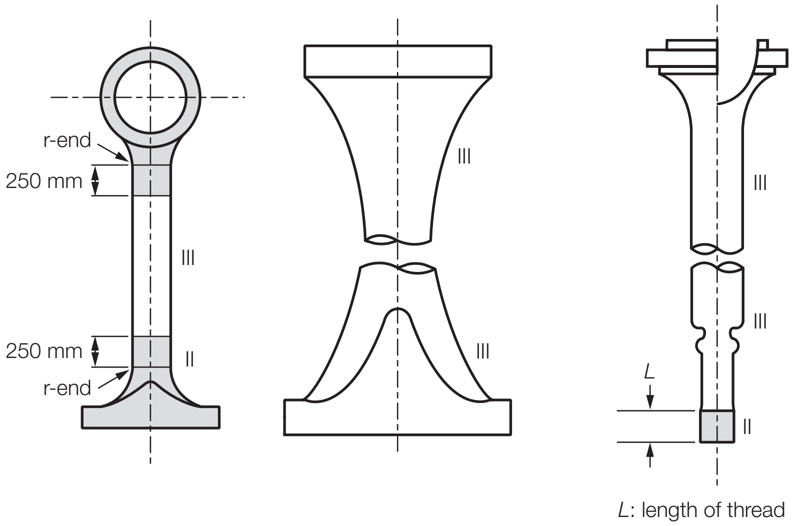
(c) Thrust shaft

NOTES
1. For hollow shafts, 360° radial scanning applies to Zone III
2. Circumferences of the bolt holes in the flanges are to be treated as Zone II
3. Axial scan from end face also required

Fig. 5.3.6 Zones for ultrasonic testing on shafts

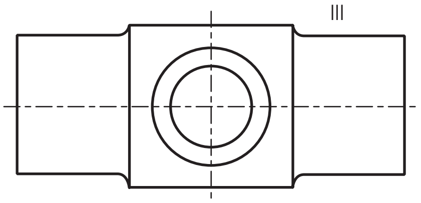


Scanning direction



(a) Connecting rod

(b) Piston rod



(c) Cross head

NOTE
Axial scan from end face also required

Fig. 5.3.7 Zones for ultrasonic testing on machinery components

■ Section 9

Austenitic stainless steel forgings

9.4 Intergranular corrosion tests

9.4.2 When an intergranular corrosion test is specified, it is to be carried out in accordance with the procedure given in ~~Ch 2,8.1~~ Ch 2,9.1.

Chapter 6

Steel Castings

Effective date 1 July 2013

■ *Section 1*

General requirements

1.7 Test material

1.7.2 Where heat treatment has been carried out, a batch is to consist of pipes or tubes of the same size, manufactured from the same types of steel and subjected to the same finishing treatment in a continuous furnace, or heat treated together in the same ~~furnace charge in a~~ batch type furnace.

Chapter 9

Copper Alloys

Effective date 1 July 2013

■ *Section 1*

Castings for propellers

1.4 Chemical composition

Table 9.1.1 Chemical composition of propeller and propeller blade castings (*Part only shown*)

Alloy designation	Chemical composition of ladle samples %
	Sn
Grade Cu 1 Manganese bronze (high tensile brass)	~~0,1~~ 1,5 max.
Grade Cu 2 Ni-manganese bronze (high tensile brass)	~~0,1~~ 1,5 max.
Grade Cu 3 Ni-aluminium bronze	0,1 max.
Grade Cu 4 Mn–aluminium bronze	1,0 max.

■ *Section 3*

Tubes

3.3 Quality

3.3.2 The tubes are to be supplied in smooth, round, straight lengths~~, free from~~ and the manufacturer is to guarantee freedom from deleterious films in the bore. The ends are to be cut clean and square with the axis of the tube and are to be de-burred.

~~3.9 Stress corrosion cracking test~~

~~*3.9.1* This is an accelerated test for detecting the presence in tubes of internal stresses which might result in failure, in storage or in service, due to stress corrosion cracking.~~

~~*3.9.2* The test is applicable only to aluminium brass and copper-nickel-iron tubes.~~

~~*3.9.3* The test specimen is to consist of a 150 mm length cut from the tube selected for mechanical tests in accordance with 3.7.2.~~

~~*3.9.4* The test is to be carried out in accordance with a National or International Standard recognised by LR or by the test method given in 3.9.5.~~

~~*3.9.5* The test specimen is to be immersed in a mercurous nitrate solution at room temperature for 30 minutes. Aluminium brass specimens are to be examined for cracks immediately after rinsing, while copper-nickel-iron specimens are to be examined 24 hours after rinsing.~~

~~*3.9.6* Should any specimen fail to meet the requirements of this test, then all tubes represented by that specimen are to be withdrawn. The tubes may be re-submitted after stress relieving treatments for full testing in accordance with 3.7 and 3.9.~~

Existing sub-Sections 3.10 *to* 3.13 *have been renumbered* 3.9 *to* 3.12.

Chapter 10

Equipment for Mooring and Anchoring

Effective date 1 July 2013

■ *Section 2* Stud link chain cables for ships

2.1 Scope

2.1.3 The design of chain cables is to be to a Standard recognised by LR, such as ISO 1704.

2.2 Manufacture

2.2.5 Where end links or enlarged links are manufactured and heat treated as part of and at the same time as the chain cable and are of the same cast heat of steel, they may be excluded from separate mechanical tests and break load tests.

2.3 Flash butt welded chain cable

2.3.3 The test links from which the mechanical test specimens are prepared are to be made as part of the chain cable and are to be heat treated with it. They may be removed from the cable prior to heat treatment provided that each sample is heat treated with, and in the same manner as, the chain it represents ~~and is subjected to the proof load appropriate to the chain grade and diameter~~ prior to preparation of the mechanical test specimens.

2.5 Forged chain cables

~~*2.5.4* Test samples in the form of forgings of similar dimensions to the links they represent and from the same cast and heat treatment charge are to be provided.~~

2.5.4 Test samples are to be provided in the form of forgings of similar dimensions to the links they represent. These test samples are to be from the same steel-making heat and heat treated together with the links they represent.

2.13 Fittings for chain cables

2.13.3 All fittings are to be manufactured to an approved manufacturing specification, and provision is to be made for tensile specimens and, where applicable, impact test specimens, *see* Table 10.2.3. ~~The test samples are to be prepared in accordance with 2.4.3 or 2.5.4 as applicable. The test specimens are to be subjected to heat treatment with the fittings they represent.~~ The mechanical test requirements are the same as those for the relevant grade of chain cable, *see* Table 10.2.1. ~~A batch of fittings is to be of the same grade, size and heat treatment charge and to have originated from a single cast of steel. Enlarged and end links need not be tested provided that they are manufactured and heat treated together with the chain cable. Mechanical tests of pins are to be taken in accordance with 3.8.15.~~

2.13.4 The test samples are to be prepared in accordance with 2.4.3 or 2.5.4 as applicable. The test specimens are to be subjected to heat treatment with the fittings they represent.

2.13.5 A batch of fittings is to be of the same grade, size and heat treatment furnace load and is to have originated from a single cast heat of steel.

2.13.6 Mechanical tests of pins are to be taken in accordance with 3.8.15.

Existing paragraphs 2.13.4 *and* 2.13.5 *have been renumbered* 2.13.7 *and* 2.13.8.

~~*2.13.6* The appropriate breaking load is to be applied for a minimum of 30 seconds to at least one item out of every batch of up to 25 (1 in 50 for lugless (Kenter) shackles), and this item is to be destroyed and not used as part of an outfit. For the purpose of break load testing, a batch of accessories is to be of the same grade, size and heat treatment charge and may consist of items from different casts, provided that the sample tested is from the cast with the lowest tensile properties. Enlarged and end links need not be tested provided that they are manufactured and heat treated together with the chain cable.~~

2.13.9 The appropriate breaking load is to be applied for a minimum of 30 seconds to at least one item out of every batch of up to 25 detachable links, shackles, swivels, swivel shackles, enlarged end links and end links and at least one item out of every batch of up to 50 for lugless (Kenter) shackles. The item tested is to be destroyed and not used as part of an outfit. For the purposes of break load testing, a batch of accessories is to consist of:

(a) the same accessory type, grade and size;
(b) the same rolling or forging or casting process; and
(c) accessories that are heat treated together in the same furnace.

2.13.10 Where a break load batch as defined in 2.13.9 requires a normalise or normalise and temper heat treatment, the size of accessories may vary within a batch provided that the heat treatment cycle is chosen to satisfy the accessory with the largest cross-section size. The batch may consist of more than one steel-making heat provided that the two accessories are break tested, one with the largest cross-section size and one with the smallest cross-section size.

2.13.11 Where a break load batch as defined in 2.13.9 requires a quench and temper heat treatment, the size of the accessories within the batch is to be the same and is limited to the same steel-making heat.

Existing paragraph 2.13.7 *has been renumbered* 2.13.12.

2.13.13 Fittings of increased dimensions or higher grade material may be used subject to approval by LR.

~~2.13.8~~ 2.13.14 Where ~~the~~ items ~~are~~ of increased dimensions~~, and have been specially approved,~~ are used or if material of a higher grade than is specified is used, ~~then~~ the breaking load is to be applied to each item, and the items so tested included with the outfit. For the purpose of this paragraph, items of increased dimensions are those so designed that their breaking strength is not less than 1,4 times the Rule minimum breaking load of the chain cable with which they are to be used.

Existing paragraphs 2.13.9 *to* 2.13.11 *have been renumbered* 2.13.15 *to* 2.13.17*.*

■ *Section 3*
Stud link mooring chain cables

3.1 Scope

3.1.2 Design of chain cables must be to a recognised Standard, such as ISO 1704; alternatively, the design may be specifically approved by LR.

Existing paragraph 3.1.2 *has been renumbered* 3.1.3*.*

3.3 Dimensions and tolerances

3.3.1 The form and proportions of links and shackles are to be in accordance with ISO/1704~~-2008~~, *see* Figs. 10.2.1 to 10.2.8. ~~Design of chain cables must be to a recognised standard, such as ISO 1704; alternatively the design may be specifically approved by LR.~~ Link tolerances are to be in accordance with 3.3.2 to 3.3.6.

3.6 Testing of completed chain cables

3.6.21 In addition to the requirements of 3.6.2, three link samples are to be selected by the Surveyors from the completed chain for breaking tests. The number of tests required is to be in accordance with Table 10.3.2. Extra links are to be provided for the mechanical tests detailed in 3.6.25. All test links are to be made as part of the chain cable and are to be heat treated with it. These may be removed from the cable prior to heat treatment provided that each sample is heat treated with, and in the same manner as, the chain it represents ~~and is subjected to the proof load appropriate to the chain grade and diameter~~ prior to selection of the mechanical test specimens. They are to be properly identified with the length of chain they represent.

CORRIGENDUM

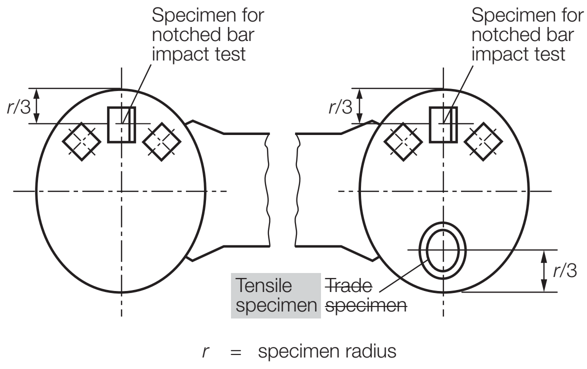

Specimen for notched bar impact test
Specimen for notched bar impact test
r/3
r/3
r/3
Tensile specimen
~~Trade specimen~~
r = specimen radius

Fig. 10.3.4 Sampling of chain links

Effective date 1 July 2013

3.8 Fittings for offshore mooring chain

~~*3.8.9* A batch is defined as fittings from the same heat of steel that have been part of the same heat treatment charge.~~

3.8.9 For fittings for mooring chain, a batch is defined as fittings from the same steel-making heat that have been heat treated together in the same furnace.

3.8.25 Fittings of increased dimensions or higher grade material may be used subject to approval by LR.

~~3.8.25~~ 3.8.26 ~~Fittings~~ Where fittings with increased dimensions, or fittings of a higher material grade~~, may be specially approved and~~ are included in an outfit~~, provided that;~~:

(a) each item ~~is~~ must be successfully tested at the required breaking load for the chain cable for which ~~they are~~ it is intended; and

(b) items of increased dimensions are so designed that their breaking strength is not less than 1,4 times the Rule minimum breaking load for the chain cable for which they are intended, and this has been verified by procedure tests.

3.9 Identification

3.9.2 The chain is to be marked as follows:

(a) at each end (the marking should identify the leading and tail end of each chain),

(b) at intervals not exceeding ~~100m~~ 100 m,

(c) on all connecting common links or shackles and the immediately adjacent links,

(d) on the first and last common link of each individual ~~charge~~ heat used in the continuous length.

■ *Section 5*
Short link chain cables

5.1 Scope

5.1.2 Provision is made for grade M(4), as defined in ISO 1834~~:1999. Allowance is also made for the requirements of ISO 4565~~.

Chapter 12
Welding Qualifications

Effective date 1 July 2013

■ *Section 2*
Welding Procedure Qualification Tests for Steels

2.3 Steel test assemblies

2.3.2 For plate tests, the direction of plate rolling relative to the weld direction is to be considered. Where the material used for the test requires longitudinal impact tests, the plate rolling direction is to be perpendicular to the weld direction and for material which requires impact testing in the transverse direction, the rolling direction is to be parallel to the weld direction. For weld tests intended for liquefied gas storage or cargo tanks and associated process pressure vessels, the direction of plate rolling is to be parallel to the weld direction in all cases.

2.7 Destructive tests for steel butt welds

2.7.3 Where approved welding consumables have been used, the longitudinal all weld metal tensile test may be omitted. For Type C independent tanks intended for liquefied gases, the all weld tensile test is mandatory for all welding procedure tests.

(*Part only shown*)
2.7.6 Transverse bend specimens of rectangular section are to be prepared with the weld centred in the middle of the specimen as shown in Fig. 12.2.5. For material of thickness 12 mm or greater, the face and root bends may be substituted by side bend tests. Where there is a significant difference between the strength of the weld and base material, longitudinal bend specimens may be used. The weld reinforcement may be removed by grinding or machining prior to testing and the edges rounded to a radius not exceeding 10 per cent of the specimen thickness. Each specimen is to be bent through an angle of at least 180°. The bend test ratio is to be the lesser of the following:

2.7.10 For pressure vessels and tanks employed in transportation of liquefied gases, Charpy impact test locations from the weld and heat affected zone are to be in accordance with Fig. 12.2.8.

Existing paragraphs 2.7.10 *and* 2.7.11 *to be renumbered* 2.7.11 *and* 2.7.12.

~~*2.7.12*~~ *2.7.13* A Vickers hardness survey is to be performed on the macro specimen taken from the weld start end of the test assembly in accordance with that shown in ~~Fig. 12.2.8~~ Fig. 12.2.9, using a test load not in excess of 10 kg. For each row of indents, there are to be a minimum of 3 individual indentations in the weld metal, the heat affected zones (both sides) and the base metal (both sides). The recommended distance between indents is 1,0 mm, but the distance between indents should not be less than the minimum specified in ISO 6507/1.

2.8 Destructive tests for steel fillet welds

2.8.4 A Vickers hardness survey is to be performed on the macro specimen taken from the weld start end of the test assembly in accordance with that shown in ~~Fig. 12.2.9~~ Fig. 12.2.10, using a test load not exceeding 10 kg.

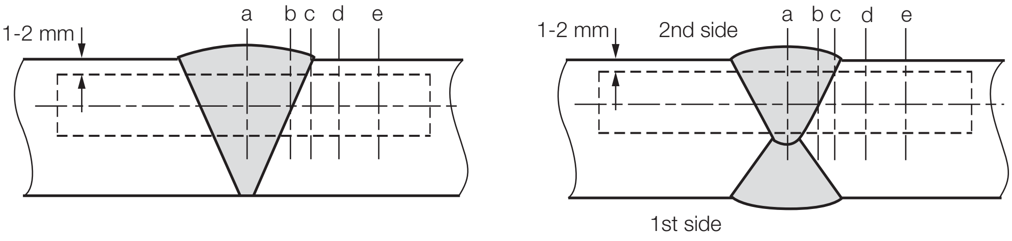
2.9 Destructive tests for T, K, Y steel nozzle welds

(*Part only shown*)
2.9.1 Full penetration ‘T’, ‘K’ and ‘Y’ joints for structural applications and nozzle welds for pressure vessels are to be sectioned for testing in accordance with ~~Fig. 12.2.10~~ Fig. 12.2.11 and tested as detailed below:

2.9.2 The impact tests are to be removed from the vertical (up) position ‘B’ in ~~Fig. 12.2.10~~ Fig. 12.2.11 and tested in accordance with 2.7.8.

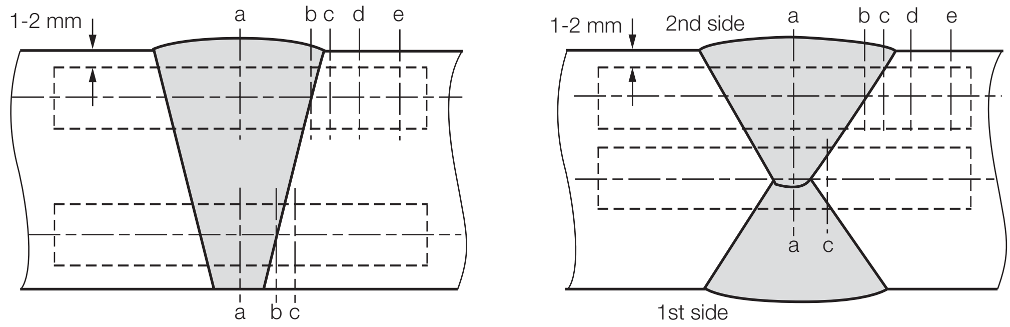
2.9.3 A Vickers hardness survey is to be performed on the macro-section removed from position ‘A’ or ‘C’ in accordance with that shown in ~~Fig. 12.2.11~~ Fig. 12.2.12 using a test load not exceeding 10 kg.

(a) *t* ≤ 50 mm, *see* Note



Note
For one side welding with thickness over 20 mm notch locations ‘a’, ‘b’ and ‘c’ are to be added on root side

(a) *t* > 50 mm



Notch locations:
a : centre of weld ‘WM’
b : on fusion line ‘FL’
c : in HAZ 1 mm from fusion line
d : in HAZ 3 mm from fusion line
e : in HAZ 5 mm from fusion line
f : in base metal remote from weld (Type C independent tanks only)

Fig. 12.2.8 Locations of V-notch tests for butt welds intended for liquefied gas containment systems

2.11 Destructive tests for weld cladding of steel

2.11.1 Where weld cladding or overlay is allowed by Chapter 13, and is considered as providing strength to the component to which it is welded, the type and location of test specimens are to be 0in accordance with ~~Fig. 12.2.12~~ Fig. 12.2.13, except that micro-sections are not required. Impact tests may be omitted where the base material does not have specified impact properties. The longitudinal tensile and bend tests are to be tested in a similar manner to transverse specimens specified in 2.7.2 and 2.7.6, respectively.

2.11.2 Where the weld cladding is not considered as contributing to the strength of the component, but is required for corrosion or wear resistance, the type and location of test specimens are to be in accordance with ~~Fig. 12.2.12~~ Fig. 12.2.13, except that tensile and impact tests are not required.

2.12 Mechanical test acceptance criteria for steels

(*Part only shown*)

2.12.1 **Longitudinal all weld metal tensile test**:

(d) For tanks intended for liquefied gases, the weld metal strength may be lower than the minimum specified for the base metal provided that the application has design approval. In such cases the strength is not to be less than that specified in the approved design.

2.12.2 **Transverse tensile test**: The tensile strength measured from the transverse tensile test is not to be less than the minimum specified for the base material used in the test. For tanks intended for liquefied gases, a lower ultimate tensile may be accepted subject to design approval as in 2.12.1(d).

Existing Fig. 12.2.8 *to* 12.2.12 *have been renumbered* Fig. 12.2.9 *to* 12.2.13.

Chapter 13

Requirements for Welded Construction

Effective date 1 July 2013

■ *Section 1*
General welding requirements

1.1 Scope

1.1.2 The requirements for fabrication and welding during construction and repair of tanks intended for transport or storage of liquefied gases are located in the *Rules and Regulations for the Construction and Classification of Ships for the Carriage of Liquefied Gases in Bulk* or the *Rules and Regulations for the Classification of a Floating Offshore installation at a Fixed Location*, as appropriate.

Existing paragraphs 1.1.2 *to* 1.1.5 *have been renumbered* 1.1.3 *to* 1.1.6.

■ *Section 2*
Specific requirements for ship hull structure and machinery

2.10 Post-weld heat treatment

2.10.4 Special consideration may be given to omit the required post-weld heat treatment. Evaluation is to be based on critical engineering assessment involving fracture mechanics testing and proposals are to be submitted which include full details of the application, materials, welding procedures, inspection procedures, design stresses, fatigue loads and cycles. Evidence will be required to demonstrate that the inspection techniques and procedures to be employed are able to detect flaws down to the sizes determined from the fracture mechanics (and or fatigue) calculations. Alternative procedures for omission of post weld heat treatment will be subject to special consideration.

2.14 Welding afloat with water backing

2.14.2 ~~Welding in, or underwater, is not permitted.~~ For new construction, conversion or permanent repairs, wet underwater welding is not permitted.

■ *Section 4*
Specific requirements for fusion welded pressure vessels

4.10 ~~Heat treatment~~ Post-weld heat treatment

4.11 Basic requirements for post-weld heat treatment of fusion welded pressure vessels

Chapter 14

Plastics Materials and other Non-Metallic Materials

Effective date 1 July 2013

■ *Section 2*
Tests on polymers, resins, reinforcements and associated materials

2.14 Plywoods

2.14.2 For structural applications in the marine environment, a minimum timber rating of moderate durability according to BS 1088-1 and BS 1088-2 is required.

■ *Section 5*
Control of material quality for composite construction

5.14 Synthetic chocking compounds

~~*5.14.1* Table 14.5.8 gives the minimum property requirements for synthetic chocking compounds.~~

~~Table 14.5.8 Minimum characteristics and~~ mechanical properties of synthetic chocking compound

Properties	Minimum value
Izod Impact Resistance	0,8 J
Barcol hardness	40
Compression	100 MPa
Water absorption	0,05%
Oil absorption (light machine)	0,05%
Creep	< 0,2%

NOTES
1. Izod, barcol, compression, and water and oil absorption tests to be performed on samples cured/post-cured to the same condition as the samples for the final creep tests.
2. Minimum creep value to be attained for a stabilised sample after 1000 hours.

5.14.1 After 1000 hours the chocking resin must be stabilised and maximum creep is to be less than or equal to 0,2 per cent.

5.14.2 Compliance with 5.14.1 is to be demonstrated at the time of chocking compound approval for a specified cure/post cure schedule. The Izod, barcol, compression, and water and oil absorption are additionally to be determined for the creep tested cure/post cure schedule.

5.14.3 Confirmation of creep, barcol and compression will be required for cure/post cure conditions which differ from those shown on the product approval certificate.

Section numbering in brackets reflects any Section renumbering necessitated by any of the Notices that update the current version of the Rules for Materials.

Chapter 3

7.6.3	Ch 2,8 *now reads* Ch 2,9

Chapter 6

5.5.3	Ch 2,8 *now reads* Ch 2,9

Chapter 12

2.7.12	Fig. 12.2.8 *now reads* Fig. 12.2.9

Chapter 13

4.8.6(d)	Fig. 12.2.8 *now reads* Fig. 12.2.9

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